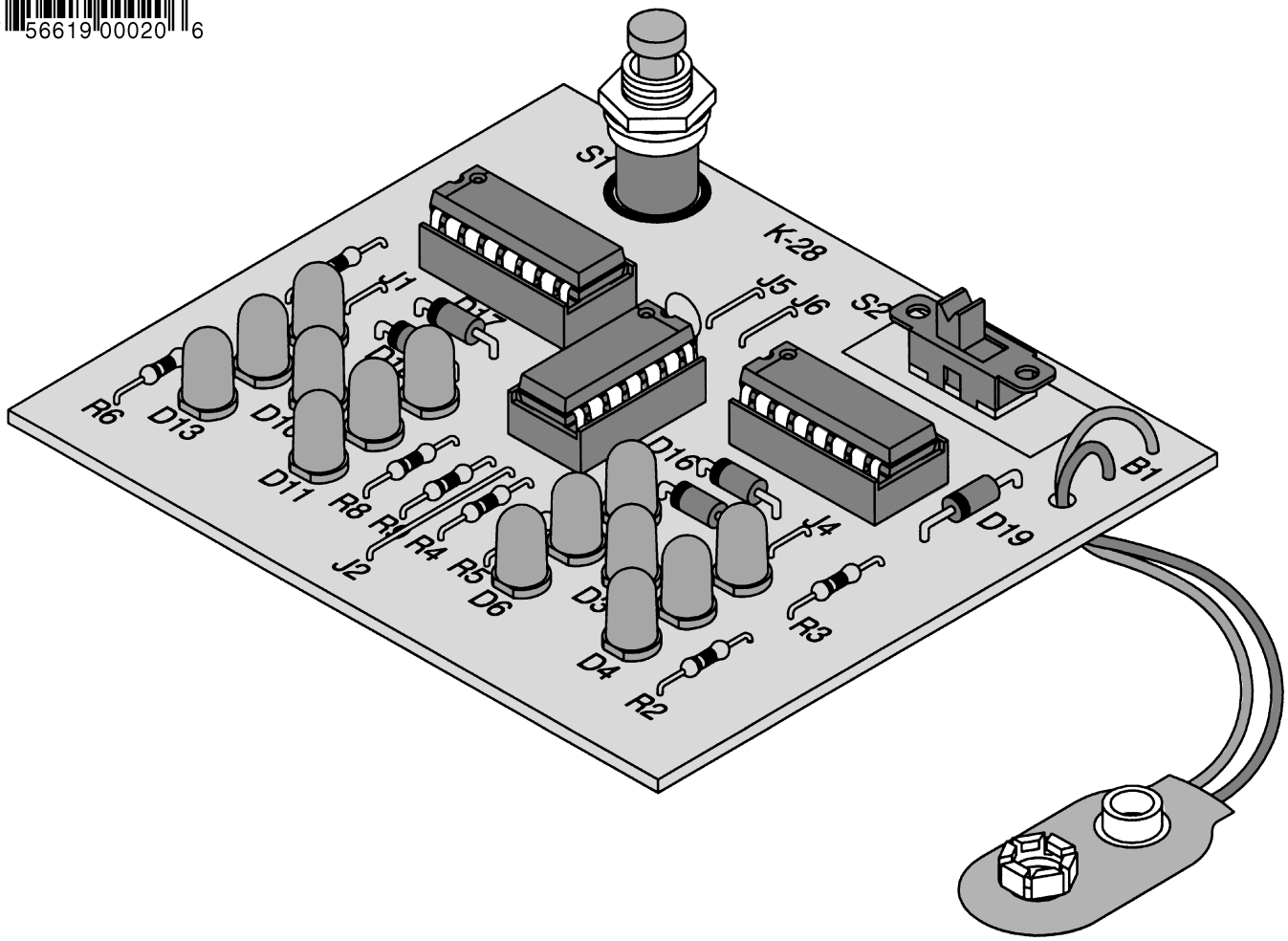
POCKET DICE KIT

MODEL K-28



Assembly and Instruction Manual

Elenco® Electronics, Inc.

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PARTS LIST

If you are a student, and any parts are missing or damaged, please see instructor or bookstore.
If you purchased this pocket dice kit from a distributor, catalog, etc., please contact Elenco® Electronics (address/phone/e-mail is at the back of this manual) for additional assistance, if needed. **DO NOT** contact your place of purchase as they will not be able to help you.

RESISTORS

Qty.	Symbol	Value	Color Code	Part #
❒ 6	R2,4,5,6,8,9	1.2kΩ 5% 1/4W	brown-red-red-gold	141200
❒ 2	R3, R7	1.5kΩ 5% 1/4W	brown-green-red-gold	141500
❒ 1	R1	100kΩ 5% 1/4W	brown-black-yellow-gold	161000

CAPACITORS

Qty.	Symbol	Value	Description	Part #
❒ 1	C1	.01μF	Discap	241031

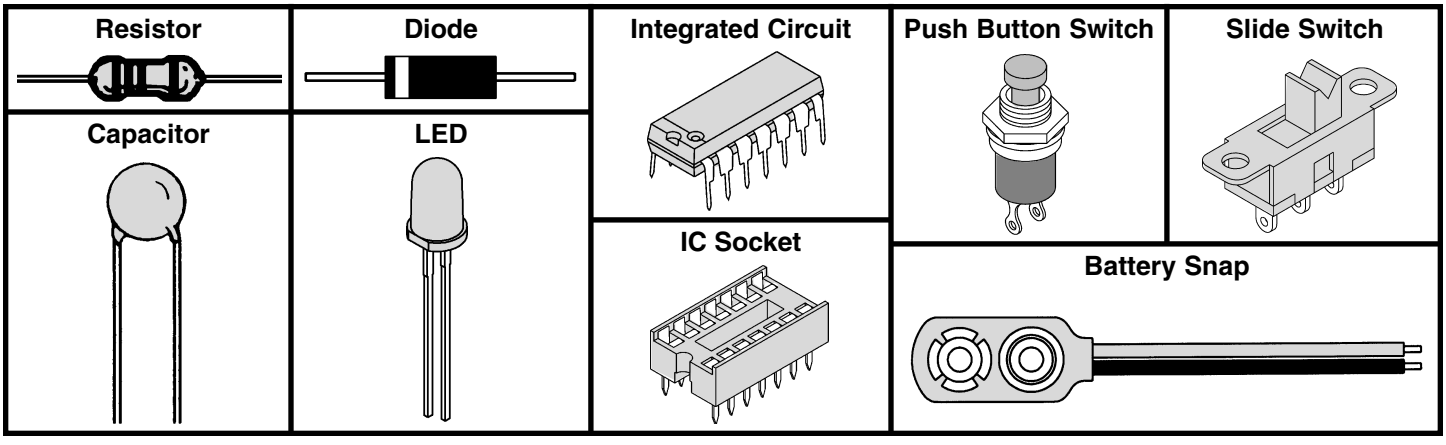
SEMICONDUCTORS

Qty.	Symbol	Value	Description	Part #
❒ 1	D19	1N4001	Diode	314001
❒ 4	D15 - D18	1N4148	Diode	314148
❒ 1	IC1	4011	Integrated Circuit	334011
❒ 2	IC2, IC3	4018	Integrated Circuit	334018
❒ 14	D1 - D14		LED (red)	350002

MISCELLANEOUS

Qty.	Symbol	Description	Part #	Qty.	Symbol	Description	Part #
❒ 1		PC Board	518028	❒ 1	B1	Battery Snap 9V	590098
❒ 1	S1	Switch push button	540001	❒ 1	IC1	IC Socket 14-pin	664014
❒ 1	S2	Switch Slide	541102	❒ 2	IC2, IC3	IC Socket 16-pin	664016

PARTS IDENTIFICATION



Batteries:

- **Do not short circuit the battery terminals.**
- **Never throw the battery in a fire or attempt to open its outer casing.**
- **Use only 9V alkaline battery (not included).**
- **Insert battery with correct polarity.**
- **Non-rechargeable batteries should not be recharged. Rechargeable batteries should only be charged under adult supervision, and should not be recharged while in the product.**
- **Remove battery when it is used up.**
- **Batteries are harmful if swallowed, so keep away from small children.**

IDENTIFYING RESISTOR VALUES

Use the following information as a guide in properly identifying the value of resistors.

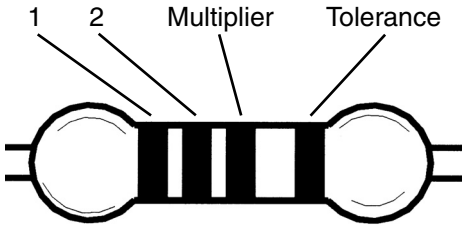
BAND 1 1st Digit	
Color	**Digit**
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

BAND 2 2nd Digit	
Color	**Digit**
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

Multiplier	
Color	**Multiplier**
Black	1
Brown	10
Red	100
Orange	1,000
Yellow	10,000
Green	100,000
Blue	1,000,000
Silver	0.01
Gold	0.1

Resistance Tolerance	
Color	**Tolerance**
Silver	±10%
Gold	±5%
Brown	±1%
Red	±2%
Orange	±3%
Green	±0.5%
Blue	±0.25%
Violet	±0.1%

BANDS



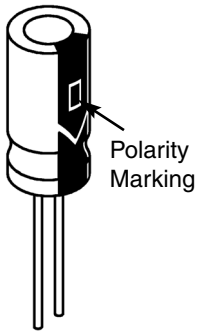
IDENTIFYING CAPACITOR VALUES

Capacitors will be identified by their capacitance value in pF (picofarads), nF (nanofarads), or μF (microfarads). Most capacitors will have their actual value printed on them. Some capacitors may have their value printed in the following manner. The maximum operating voltage may also be printed on the capacitor.

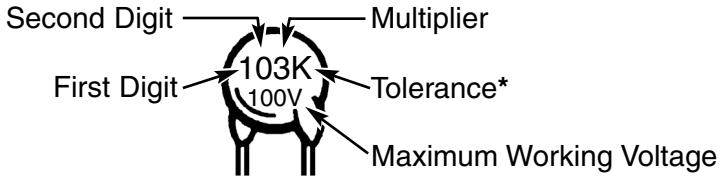
Electrolytic capacitors have a positive and a negative electrode. The negative lead is indicated on the packaging by a stripe with minus signs and possibly arrowheads.

Warning:

If the capacitor is connected with incorrect polarity, it may heat up and either leak, or cause the capacitor to explode.



Multiplier	For the No.	0	1	2	3	4	5	8	9
	Multiply By	1	10	100	1k	10k	100k	.01	0.1



The value is 10 x 1,000 =
10,000pF or .01μF 100V

*The letter M indicates a tolerance of ±20%
The letter K indicates a tolerance of ±10%
The letter J indicates a tolerance of ±5%

Note: The letter "R" may be used at times to signify a decimal point; as in 3R3 = 3.3

METRIC UNITS AND CONVERSIONS

Abbreviation	Means	Multiply Unit By	Or
p	pico	.000000000001	10^{-12}
n	nano	.000000001	10^{-9}
μ	micro	.000001	10^{-6}
m	milli	.001	10^{-3}
–	unit	1	10^{0}
k	kilo	1,000	10^{3}
M	mega	1,000,000	10^{6}

1. 1,000 pico units	= 1 nano unit
2. 1,000 nano units	= 1 micro unit
3. 1,000 micro units	= 1 milli unit
4. 1,000 milli units	= 1 unit
5. 1,000 units	= 1 kilo unit
6. 1,000 kilo units	= 1 mega unit

INTRODUCTION

Dice are the most ancient gambling implement known to man, and the most universal, having been known in nearly all parts of the world since earliest times. Today they are used in some games of skill, such as backgammon, but are used chiefly in gambling games. In the United States the most popular dice game is Craps.

CIRCUIT DESCRIPTION

Each die consists of seven light emitting diodes (LEDs). Since there are two dice, we need 14 LEDs. The trick is to light the right LEDs to give the six possible dice combinations.

The Pocket Dice kit consists of three main circuits. They are (1) a clock oscillator, (2) a presettable counter and (3) a decoder circuit.

Figure 1 shows a block diagram of the functions. We will study each function and get an understanding on how the Pocket Dice kit works.

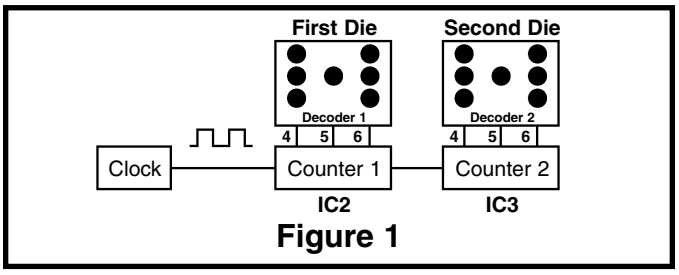


Figure 1

Referring to Figure 1, the clock puts out a series of pulses at about 60 per second. The counter IC2 receives the clock pulses and outputs 0's or 1's on pins 4, 5 and 6. The outputs can represent any one of six combinations 000, 001, 010, 110, 111 or 101. Each time the clock puts out a pulse, the output of the counter changes. The 0's and 1's are fed to the decoder circuit which transforms the 0 and 1 combinations into a series of lit LEDs to display the die patterns. Pin 13 of IC2 changes state once every time the IC passes through the six state sequence. Thus, it puts out a pulse at a frequency of one-sixth of the digital clock or 10 pulses per second. This signal is fed the input of IC3 and becomes its clock input. IC3 and its decoder work the same as IC2 except at a slower clock rate.

THE CLOCK FUNCTION

Figure 2 shows the diagram of the clock circuit. It consists of two NAND gate digital integrated circuits. In our circuit, the two inputs are tied together which forms an inverter circuit. When the input of IC1A is low, the output will be high, thus when the input of IC1B is high, its output will be low. This output is fed to the input of IC1A via capacitor C1 and is called positive feedback, a key element to make a circuit oscillate. The frequency of oscillation depends on the value of capacitor C1 and resistor R1. The value chosen results in a frequency of approximately 60 cycles per second. The output at IC1B will be a square wave.

In the Pocket Dice kit, we want the oscillator to run for a short time. As long as the oscillator is running, the dice will be constantly changing numbers. The number changes once with every cycle, or 60 times per second. For the dice to come up with a number, we must stop the clock. This is done by shorting out the feedback with switch SW1. Once the switch is closed, the clock will stop and a random number will appear on the dice.

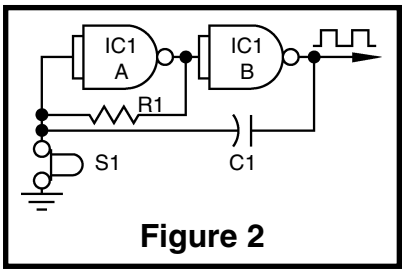


Figure 2

THE PRESETTABLE COUNTER FUNCTION

IC2 and IC3 are the presettable counters. These counters convert the clock pulses in six combinations of "1" and "0". These IC's have a single input at pin 14 and three outputs on pins 4, 5 and 6. With every pulse change at the input, the output will change as shown in Figure 3. Note the corresponding dice number as the result of the 0 and 1 output of pins 4, 5 and 6.

By tying pin 6 to pin 1, we programmed the counter to put out only 6 combinations as shown in Figure 3. Every time the clock puts out a pulse, the counter will change its output. On the first pulse, the counter pins 4 and 5 will be low (0) and pin 6 will be high (1). This results in the die number two. The next clock pulse will result in the counter output of all lows (0) and the die will show the number one. Thus, the sequence continues until all six numbers are shown.

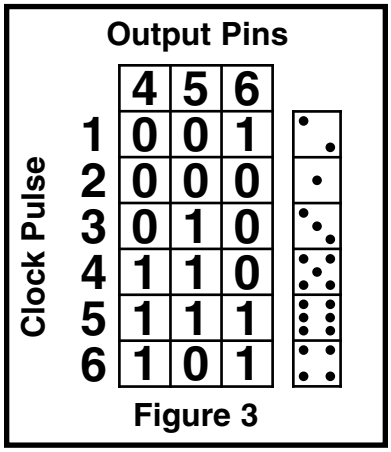


Figure 3

The next pulse will repeat the process with two showing on the die.

The output of IC2 also drives IC3. This results in IC3 output changing in step with IC2, but at a slower rate.

THE DECODER CIRCUIT

The decoder circuit takes the output of the presettable counter and lights the correct LEDs. Figure 4 shows the decoder circuit. It consists of a NAND gate and an OR gate. The OR gate is formed by two diodes. The purpose of the decoder circuits is to "decode" the outputs of pins 4, 5 and 6 of IC2 or IC3 to light the correct LEDs. The truth tables for the NAND and the OR gates are shown in Figure 5. They show the output C versus the inputs A and B. Thus, if the inputs of the NAND gate are both low (0), the output will be high (1).

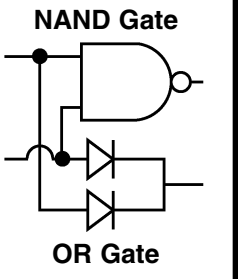


Figure 4

NAND			OR		
A	B	C	A	B	C
0	0	1	0	0	0
1	0	1	1	0	1
0	1	1	0	1	1
1	1	0	1	1	1

Figure 5

Figure 6 shows the wiring of the LEDs to the NAND and OR gates output. Note that when IC pin 10 is low, LED D2 and D1 will light. Also, when pin 5 or 6 of IC2 are high, LEDs D4 and D5 will light. Figure 7 shows which LEDs are being lit as a result of the outputs of pin 4, 5 and 6 of IC2 or IC3.

Let's go through a couple of decodings to see how it works. Refer to Figures 6 and 7. Remember an LED will light when the cathode is low and the anode is high as shown in Figure 8.

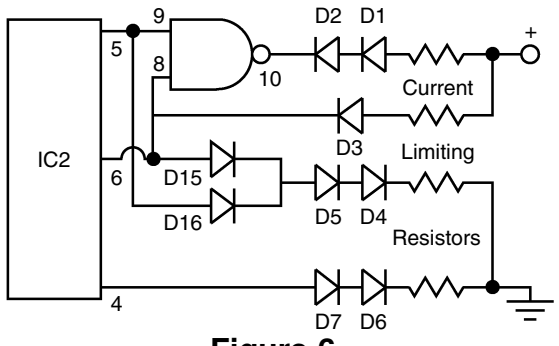


Figure 6

When the die displays a one, only LED D3 will light. For this to happen, output pin 4, 5 and 6 or IC2 will have to go low (0) and the following will result.

1) D3 turns on as its cathode will be low.
2) The input of the NAND gate is low therefore its output will be high. D2 and D1 will not light.
3) The input of the OR gate is low, so its output will be low. Thus, D4 and D5 will not light.
4) Pin 4 of IC2 is low, therefore LED D6 and D7 will not light.

Let's try another number - 3. Here we must light LEDs D3, D4 and D5. The output of pin 4 is low, pin 5 and pin 6 low (0, 1, 0).

1) Pin 6 is low, therefore LED D3 will light.
2) Pin 5 is high, Therefore the outputs of the OR gate will be high, lighting LED D4 and D5.
3) Pin 4 is low, therefore LEDs D6 and D7 will not light.
4) The inputs of the NAND gate are high and low, therefore the NAND gate output will be high and LEDs D1 and D2 will not light.

Try to figure out the other four patterns. It actually can be fun.

Pins on IC2				
4	5	6	LEDs Lit	Die Number
1	1	1	D4, D1, D7, D6, D2, D5	Six
1	1	0	D4, D7, D6, D5, D3	Five
1	0	1	D4, D7, D6, D5	Four
0	1	0	D4, D3, D5	Three
0	0	1	D4, D5	Two
0	0	0	D3	One

Figure 7

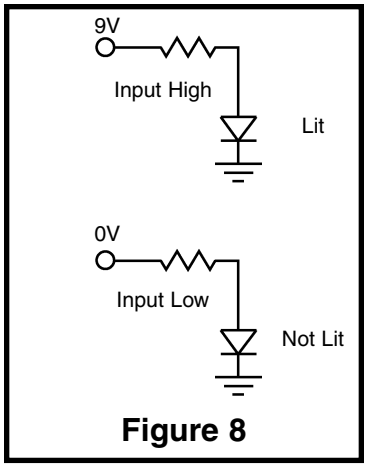


Figure 8

CONSTRUCTION

Introduction

The most important factor in assembling your K-28 Pocket Dice Kit is good soldering techniques. Using the proper soldering iron is of prime importance. A small pencil type soldering iron of 25 - 40 watts is recommended. **The tip of the iron must be kept clean at all times and well-tinned.**

Solder

For many years leaded solder was the most common type of solder used by the electronics industry, but it is now being replaced by lead-free solder for health reasons. This kit contains lead-free solder, which contains 99.3% tin, 0.7% copper, and has a rosin-flux core.

Lead-free solder is different from lead solder: It has a higher melting point than lead solder, so you need higher temperature for the solder to flow properly. Recommended tip temperature is approximately 700°F; higher temperatures improve solder flow but accelerate tip decay. An increase in soldering time may be required to achieve good results. Soldering iron tips wear out faster since lead-free solders are more corrosive and the higher soldering temperatures accelerate corrosion, so proper tip care is important. The solder joint finish will look slightly duller with lead-free solders.

Use these procedures to increase the life of your soldering iron tip when using lead-free solder:

- Keep the iron tinned at all times.
- Use the correct tip size for best heat transfer. The conical tip is the most commonly used.
- Turn off iron when not in use or reduce temperature setting when using a soldering station.
- Tips should be cleaned frequently to remove oxidation before it becomes impossible to remove. Use Dry Tip Cleaner (Elenco® #SH-1025) or Tip Cleaner (Elenco® #TTC1). If you use a sponge to clean your tip, then use distilled water (tap water has impurities that accelerate corrosion).

Safety Procedures

- **Always wear safety glasses or safety goggles to protect your eyes when working with tools or soldering iron, and during all phases of testing.**
- Be sure there is **adequate ventilation** when soldering.
- Locate soldering iron in an area where you do not have to go around it or reach over it. Keep it in a safe area away from the reach of children.
- **Do not hold solder in your mouth.** Solder is a toxic substance. Wash hands thoroughly after handling solder.

Assemble Components

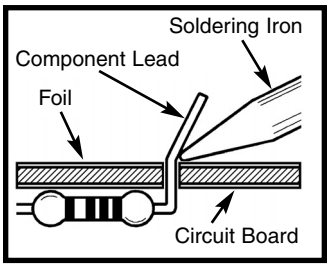
In all of the following assembly steps, the components must be installed on the top side of the PC board unless otherwise indicated. The top legend shows where each component goes. The leads pass through the corresponding holes in the board and are soldered on the foil side.
Use only rosin core solder.

DO NOT USE ACID CORE SOLDER!

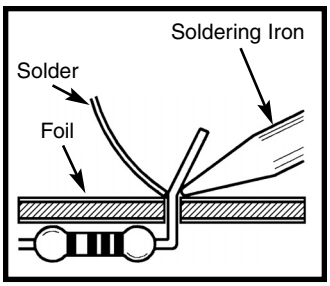
What Good Soldering Looks Like

A good solder connection should be bright, shiny, smooth, and uniformly flowed over all surfaces.

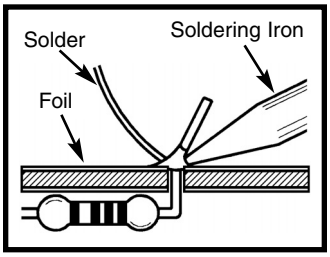
1. Solder all components from the copper foil side only. Push the soldering iron tip against both the lead and the circuit board foil.



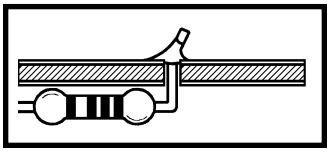
2. Apply a small amount of solder to the iron tip. This allows the heat to leave the iron and onto the foil. Immediately apply solder to the opposite side of the connection, away from the iron. Allow the heated component and the circuit foil to melt the solder.



3. Allow the solder to flow around the connection. Then, remove the solder and the iron and let the connection cool. The solder should have flowed smoothly and not lump around the wire lead.

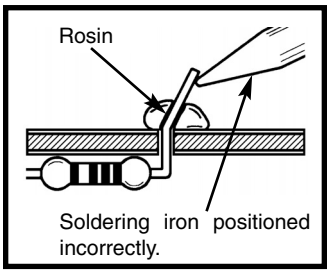


4. Here is what a good solder connection looks like.

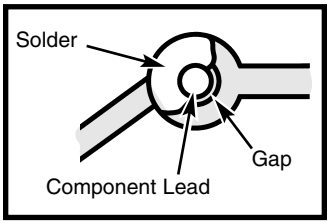


Types of Poor Soldering Connections

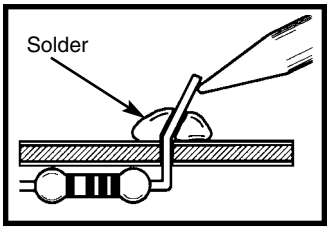
1. **Insufficient heat** - the solder will not flow onto the lead as shown.



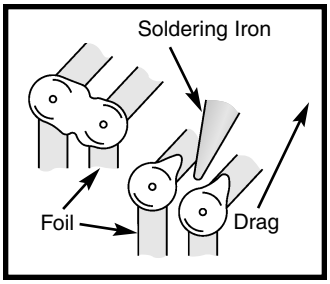
2. **Insufficient solder** - let the solder flow over the connection until it is covered.
Use just enough solder to cover the connection.



3. **Excessive solder** - could make connections that you did not intend to between adjacent foil areas or terminals.



4. **Solder bridges** - occur when solder runs between circuit paths and creates a short circuit. This is usually caused by using too much solder.
To correct this, simply drag your soldering iron across the solder bridge as shown.



ASSEMBLE COMPONENTS TO THE PC BOARD

☐ S1 - Push Button Switch

☐ J5 - Jumper Wire
☐ J6 - Jumper Wire
(see Figure A)

☐ C1 - .01µF (103) Capacitor

☐ IC3 - 16-pin Socket
☐ IC3 - 4018 Integrated Circuit
(see Figure B)

☐ R7 - 1.5kΩ 5% 1/4W Resistor
(brown-green-red-gold)

☐ J1 - Jumper Wire
(see Figure A)

☐ D17 - 1N4148 Diode
☐ D18 - 1N4148 Diode
(see Figure C)

☐ R6 - 1.2kΩ 5% 1/4W Resistor
(brown-red-red-gold)

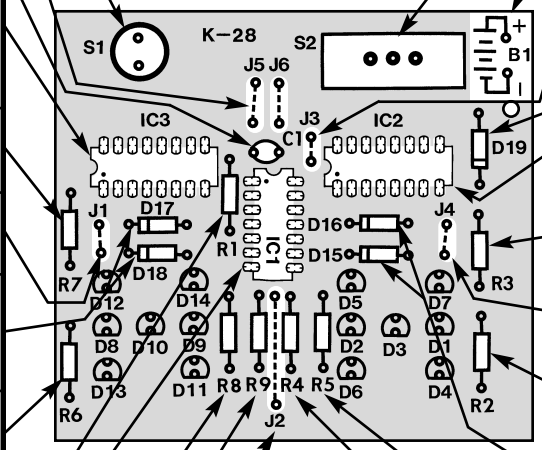
☐ R1 - 100kΩ 5% 1/4W Resistor
(brown-black-yellow-gold)

☐ IC1 - 14-pin Socket
☐ IC1 - 4011 Integrated Circuit
(see Figure B)

☐ R8 - 1.2kΩ 5% 1/4W Resistor
(brown-red-red-gold)

☐ R9 - 1.2kΩ 5% 1/4W Resistor
(brown-red-red-gold)

☐ J2 - Jumper Wire
(see Figure A)



☐ S2 - Slide Switch

☐ B1 - Battery Snap 9V
(see Figure D)

☐ J3 - Jumper Wire
(see Figure A)

☐ D19 - 1N4001 Diode
(see Figure C)

☐ IC2 - 16-pin Socket
☐ IC2 - 4018 Integrated Circuit
(see Figure B)

☐ R3 - 1.5kΩ 5% 1/4W Resistor
(brown-green-red-gold)

☐ J4 - Jumper Wire
(see Figure A)

☐ R2 - 1.2kΩ 5% 1/4W Resistor
(brown-red-red-gold)

☐ D16 - 1N4148 Diode
☐ D15 - 1N4148 Diode
(see Figure C)

☐ R5 - 1.2kΩ 5% 1/4W Resistor
(brown-red-red-gold)

☐ R4 - 1.2kΩ 5% 1/4W Resistor
(brown-red-red-gold)

Figure A

Use a discarded resistor lead for a jumper wire. Bend the wire to the correct length and mount it to the PC board.

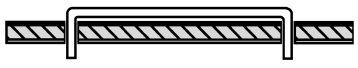


Figure B

Insert the IC socket into the PC board with the notch in the direction shown on the top legend. Solder the IC socket into place. Insert the IC into the socket with the notch in the same direction as the notch on the socket.

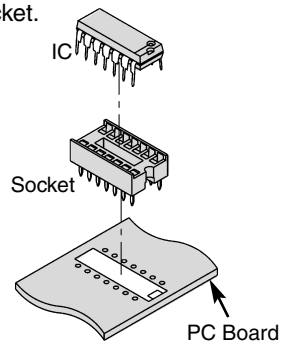


Figure C

Mount the diode with the band in the same direction shown on PC board.

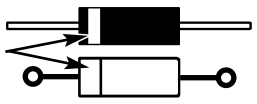
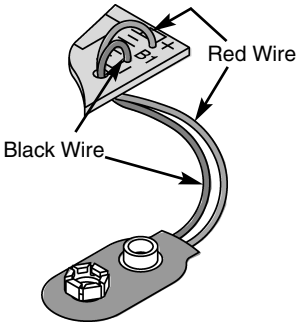


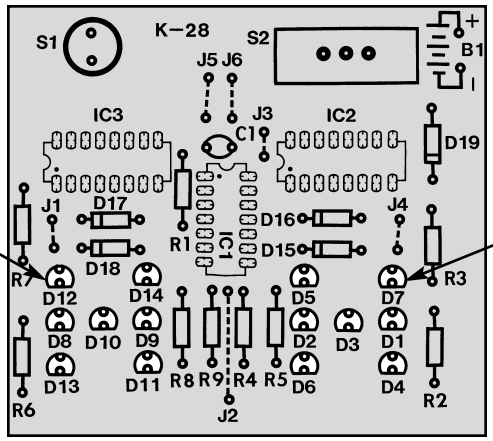
Figure D

Mount the battery snap to B1 on the PC board as shown below with the red wire in the (+) hole and the black wire in the (–) hole.



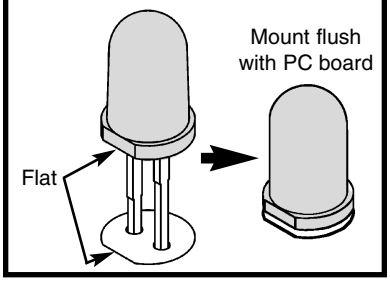
ASSEMBLY CONTINUED

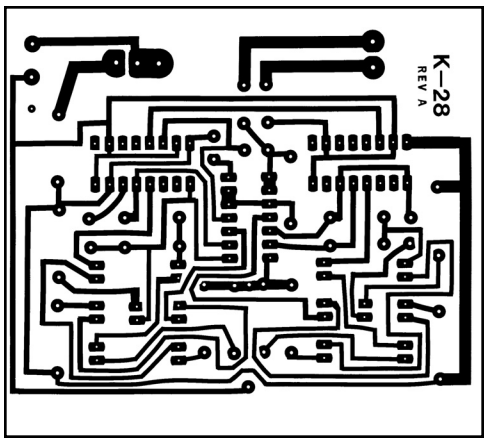
☐ D8 - LED (red)
☐ D9 - LED (red)
☐ D10 - LED (red)
☐ D11 - LED (red)
☐ D12 - LED (red)
☐ D13 - LED (red)
☐ D14 - LED (red)
(see Figure E)



☐ D1 - LED (red)
☐ D2 - LED (red)
☐ D3 - LED (red)
☐ D4 - LED (red)
☐ D5 - LED (red)
☐ D6 - LED (red)
☐ D7 - LED (red)
(see Figure E)

Figure E
Mount the LED with the flat side in the same direction as marked on the PC board.





Foil Side of PC Board

TROUBLESHOOTING

Contact Elenco® Electronics if you have any problems. **DO NOT** contact your place of purchase as they will not be able to help you.

1. One of the most frequently occurring problems is poor solder connections.
   a) Tug slightly on all parts to make sure that they are indeed soldered.
   b) All solder connections should be shiny. Resolder any that are not.
   c) Solder should flow into a smooth puddle rather than a round ball. Resolder any connection that has formed into a ball.
   d) Have any solder bridges formed? A solder bridge may occur if you accidentally touch an adjacent foil by using too much solder or by dragging the soldering iron across adjacent foils. Break the bridge with your soldering iron.
2. Be sure that all components have been mounted in their correct places.
   a) Be sure that diodes D15-D19 have not been installed backwards. The band on the diodes should be in the same direction as shown on the top legend.
   b) Be sure that LEDs D1-D14 have not been installed backwards. The flat side on the LEDs should be in the same direction as shown on the top legend.
   c) Have the ICs been inserted into their sockets correctly? The notch or dot on the ICs should be in the same direction as shown on the top legend.
   d) Be sure to use a fresh 9-volt battery.

CRAPS

Players: Any number from two and up. The players bet amongst themselves. In gambling houses, the players are grouped around a large table resembling a billiard table, stenciled with a layout shown where bets should be placed and what odds are paid.

The Play: The player who starts the game places in the center whatever he wishes to bet and announces its amount. Any other player or players may fade such portions of the bet as they wish, by placing that amount in the center with the shooters bet. Any part of the bet not faded is withdrawn by the shooter. No more than the amount offered may be faded.

The shooter rolls the dice. The shooter wins if his first roll is a 7 or 11 (a natural). He loses if it is a 2, 3 or 12 (craps); he has a point to make if it is a 4, 5, 6, 8, 9 or 10. When he gets a point, the result is not yet decided. He must roll them again and again, as often as necessary, and he will win if his point appears before a 7, but he will lose if a 7 appears first. All intervening rolls are meaningless.

When the shooter loses, those who faded him take such part of the center bets as belong to them (always exactly double the amount they bet, for all center bets are at even money). When the shooter wins (passes) all of the money in the center belongs to him and he may make another center bet if he wishes, increasing or decreasing his previous bet as he sees fit, but no one is ever forced to bet, and he may give up the dice if he prefers.

The shooter loses the dice when he gets a point and fails to make it. In this case, or when he voluntarily passes the dice, the player at his left becomes the next shooter.

QUIZ

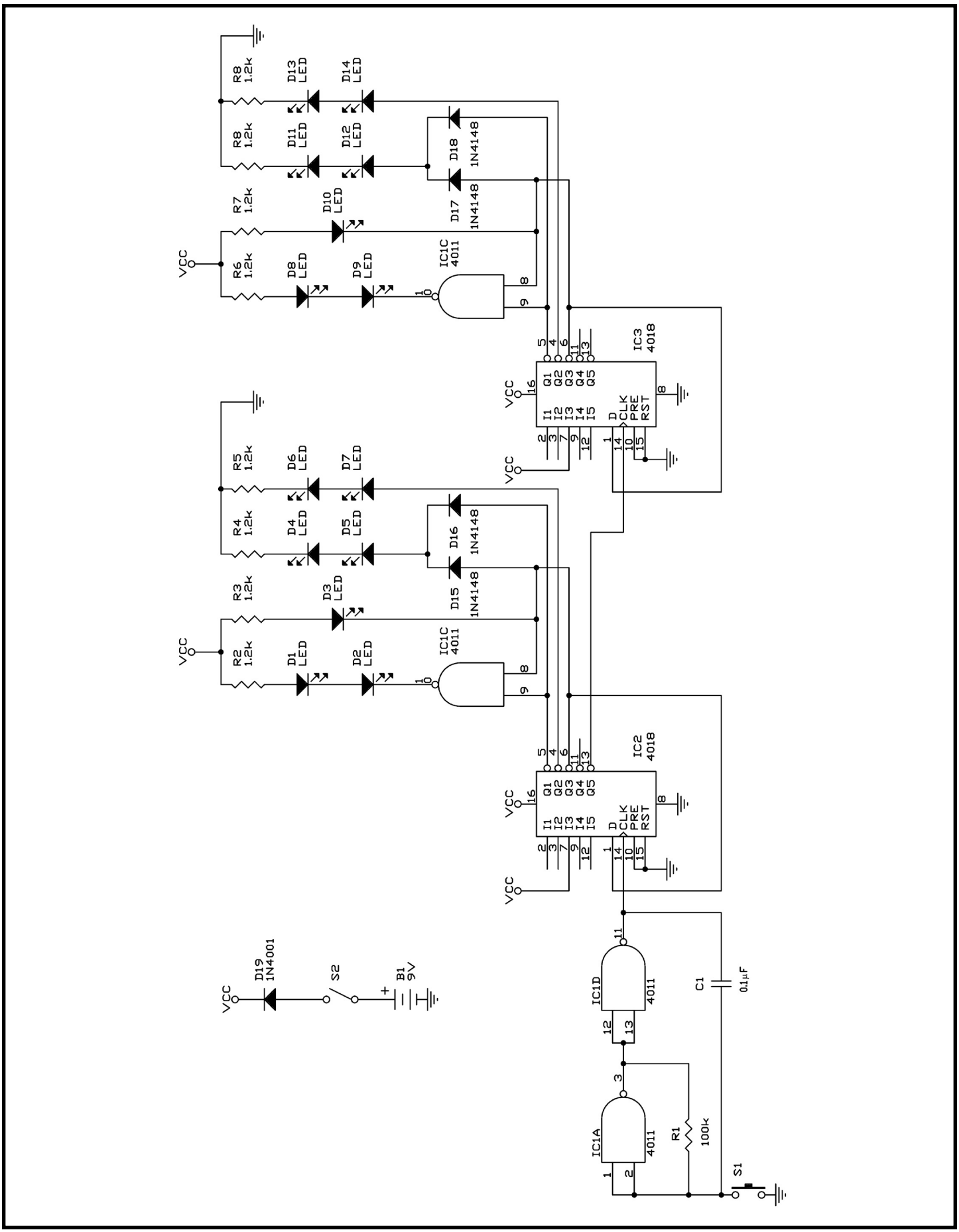
1. How many pulses per second does the clock circuit output?
   - ❒ A. 10
   - ❒ B. 25
   - ❒ C. 60
   - ❒ D. 2
2. The output of the counter can be one of _____ combinations.
   - ❒ A. 100
   - ❒ B. 6
   - ❒ C. 30
   - ❒ D. 200
3. What type of logic gate is IC1?
   - ❒ A. OR
   - ❒ B. AND
   - ❒ C. XNOR
   - ❒ D. NAND
4. The frequency of the clock circuit depends on the value of capacitor C1 and _____.
   - ❒ A. diode D1.
   - ❒ B. IC2.
   - ❒ C. resistor R1.
   - ❒ D. LED D3.
5. How many of IC2 outputs pins are used.
   - ❒ A. 3
   - ❒ B. 5
   - ❒ C. 1
   - ❒ D. 4
6. By tying pin 6 to pin _____, we program the counter to output only _____ combinations.
   - ❒ A. 14,8
   - ❒ B. 2, 5
   - ❒ C. 13, 7
   - ❒ D. 1,6
7. The OR gate in the circuit is formed by two _____.
   - ❒ A. resistors.
   - ❒ B. LED's.
   - ❒ C. diodes.
   - ❒ D. capacitors.
8. What die number lights up if pins 4 and 5 are high and 6 is low on IC2?
   - ❒ A. two
   - ❒ B. nine
   - ❒ C. five
   - ❒ D. one
9. Each die consists of how many LED's?
   - ❒ A. 10
   - ❒ B. 7
   - ❒ C. 12
   - ❒ D. 10
10. The output of the clock circuit produces a _____ wave.
    - ❒ A. triangle
    - ❒ B. ramp
    - ❒ C. saw
    - ❒ D. square

Answers: 1) C; 2) B; 3) D; 4) C; 5) A; 6) D; 7) C; 8) C; 9) B; 10) D

DEFINITION OF TERMS

Capacitor	An electrical component that can store electrical pressure (voltage) for periods of time.
Color Code	A method for marking resistors using colored bands.
Digital Circuit	A wide range of circuits in which all inputs and outputs have only two states, such as high/low.
Diode	An electronic device that allows current to flow in only one direction.
Disc Capacitor	A type of capacitor that has low capacitance and is used mostly in high frequency circuits.
Farad, (F)	The unit of measure for capacitance.
Feedback	To adjust the input to something based on what its output is doing.
Frequency	The rate at which something repeats.
Ground	A common term for the 0V or "–" side of a battery or generator.
Integrated Circuit	A type of circuit in which transistors, diodes, resistors, and capacitors are all constructed on a semiconductor base.
Kilo- (K)	A prefix used in the metric system. It means a thousand of something.
LED	Common abbreviation for light emitting diode.
Leads	The wires sticking out of an electronic component, used to connect it to the circuit.
Light Emitting Diode	A diode made from gallium arsenide that has a turn-on energy so high that light is generated when current flows through it.
Meg- (M)	A prefix used in the metric system. It means a million of something.
Micro- (μ)	A prefix used in the metric system. It means one millionth (0.000001) of something.
Milli- (m)	A prefix used in the metric system. It means one thousandth (0.001) of something.
NAND Gate	A type of digital circuit which gives a HIGH output if some of its inputs are LOW.
NOR Gate	A type of digital circuit which gives a HIGH output if none of its inputs are HIGH.
Ohm, (Ω)	The unit of measure for resistance.
OR Gate	A type of digital circuit which gives a HIGH output if any of its inputs are HIGH.
Oscillator	A circuit that uses feedback to generate an AC output.
Printed Circuit Board	A board used for mounting electrical components. Components are connected using metal traces "printed" on the board instead of wires.
Resistance	The electrical friction between an electric current and the material it is flowing through; the loss of energy from electrons as they move between atoms of the material.
Resistor	Components used to control the flow of electricity in a circuit. They are made of carbon.
Schematic	A drawing of an electrical circuit that uses symbols for all the components.
Semiconductor	A material that has more resistance than conductors but less than insulators. It is used to construct diodes, transistors, and integrated circuits.
Series	When electrical components are connected one after the other.
Short Circuit	When wires from different parts of a circuit (or different circuits) connect accidentally.
Solder	A tin-lead metal that becomes a liquid when heated to above 360 degrees. In addition to having low resistance like other metals, solder also provides a strong mounting that can withstand shocks.
Switch	A device to connect ("closed" or "on") or disconnect ("open" or "off") wires in an electric circuit.
Voltage	A measure of how strong an electric charge across a material is.
Voltage Divider	A resistor configuration to create a lower voltage.
Volts (V)	The unit of measure for voltage.

SCHEMATIC DIAGRAM



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